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tives in the community and the need of sanatoria. In malaria they show the prevalence of the disease, the need for drainage and other antimosquito work, the efficiency of such work when in operation, and when a change in the prophylactic measures is needed, or additional ones are necessary. In typhoid fever they show faults in the water supply or in the control of the production and distribution of milk, or in the disposal of excreta in special localities.

6. Morbidity reports when recorded over a period of time and properly compiled become a record of the past occurrence of disease. They show the relative prevalence of disease from year to year and under varying conditions. They show the effect of the introduction of public-health measures and of sanitary works. They give a history of disease not obtainable in their absence.

Conclusion.

The practicing physician has responsibilities in regard to the registration of births and deaths, and the reporting of cases of the notifiable diseases which he alone can perform. If he fails to register a birth he is neglecting the welfare of his patients, the child, and its mother. If he fails to give accurately the data called for in the medical part of a death certificate he is neglecting the welfare of the community. If he fails to report promptly his cases of the notifiable diseases he is obstructing the work of the health department and making difficult the control of disease and the protection of the health and lives of his fellow citizens.

MILK-BORNE TYPHOID FEVER.

REPORT OF AN OUTBREAK AT GALLUP, N. MEX.

By F. C. Smith, Surgeon, United States Public Health Service.

The investigation, of which this is a report, was made in compliance with a request to the Surgeon General, United States Public Health Service, from the mayor and health officer of Gallup, October 15, 1915.

Character of the Outbreak.

About 80 cases of sickness occurred in the town of Gallup between September 18 and October 12, 1915, which were diagnosed by some of the local physicians as typhoid fever, but by others as "mountain fever" and "bilious mountain fever," by which it appears was meant a disease similar to but quite distinct from typhoid fever. The epidemic was characterized by the presence of many mild and abortive cases. Constipation was the rule. There was apparently no prevailing gastro-enteritis, which so commonly precedes or accompanies an outbreak of typhoid. The initial symptoms were often those of influenza. The fever sometimes reached normal at the end of two weeks, and many patients were confined to bed for only a few days. On the other hand, there were a number of severe cases of typical typhoid fever, with five deaths, and the mild form of fever prevalent had many of the characteristic symptoms and physical signs of typhoid.

Diagnosis.

Blood drawn from six of the doubtful cases, on the morning the investigation was begun, and sent to an Albuquerque laboratory, was reported by wire on the following day, October 19, positive in each case for the agglutination test. Further confirmation of the diagnosis of typhoid was subsequently received from the United States Hygienic Laboratory, where specimens of blood had also been sent.

Immediate Suppressive Measures.

A preliminary survey made October 18 had shown that nearly all the cases of fever occurred upon the route of the principal dairyman. A visit to his farm, 3 miles below the town, revealed the fact that the premises, including the well, had been flooded about six weeks previously with water containing the effluent from the town sewer which discharged into an arroyo, the Rio Puercos, about 2½ miles above the dairy farm. An improvised pasteurizing plant was made and installed under the writer's direction on October 19 and began operation the same day. The problem of pasteurization was simplified by the fact that the milk was bottled at the distributing station in town, at which place pasteurization of the finished product was undertaken.

At this time, October 19, it seemed possible that there might be other sources than the one dairy. Accordingly, the local press was requested to give notice that as a temporary measure all drinking water should be boiled and all milk not pasteurized when delivered should be scalded. It is not probable that any large number of persons heeded this warning.

Measures were taken to secure a visiting nurse for the teaching of bedside prophylaxis, and she arrived a few days later. A circular of instructions, "Measures to prevent the spread of infection from the bedside of a typhoid fever patient," the same being an excerpt from Public Health Bulletin No. 69, was also printed for distribution. The local druggists were advised to stock with quantities of chloride of lime, for which there was a heavy demand when the visiting nurse arrived and attendants on the sick were more carefully instructed in preventive measures.

Detailed Investigation.

Water supply.—All water at Gallup is from cased and sealed driven wells, from 400 to 1,561 feet deep, distribution being made by a municipally-owned piping system reaching all parts of the town.

Town well No. 1, 1,118 feet deep, contained 8 colon bacilli per cubic centimeter. A large underground concreted mixing cistern near by had a large crack in the bottom, through which water passed out from the filled cistern, or in from the supersaturated subsoil whenever the cistern had been nearly emptied by the force pump supplying the mains. An old, insantiary vault privy was located 50 feet from the cistern and 60 feet from the well. About 30 families lived on the steep, unsewered street immediately above the well and cistern. The log of the well shows the first 75 feet to be "wash, with streaks of sand."

Milk supply.—Gallup has one principal dairy, A, which supplied 186 households. It delivered milk to private families in bottles, and to two soda fountains, X and Y, in cans. Its customers included several boarding houses and small restaurants. Milk was furnished by 13 cow owners, in small amounts, to 84 other families, while 6 owners supplied themselves only. There are about 425 households in the town, of which the remaining 149, comprising the poorer people, used no fresh milk.

Soda fountain X dispensed ice cream purchased in Albuquerque, but sold milk shakes and malted milk made with raw milk from dairy A. Soda fountain Y sold milk shakes and also made its own ice cream, mixing milk from dairy A with cream shipped in from a Colorado town. This ice cream was sold over the counter and was marketed at Holbrook, Ariz. It was also peddled on the streets of Gallup and at five near-by mine towns, the largest of which, Allison, has an estimated population of 560. None of these mine towns received milk from dairy A in any other way, nor did they use Gallup water.

Sewage disposal.—The municipal sewer ramifies to all major parts of town and discharges about one-half mile below into the Puercos, which is a dry arroyo part of the year and a considerable stream only after rains. Unscreened, uncleaned privies of primitive type are in common use and are found throughout all parts of the town. Some overhang the Puercos, which also receives the surface wash from both hillsides on which the town is built as well as the effluent from a sewer from the Atchison, Topeka & Santa Fe roundhouse and shop near the upper end of town. A privately owned sewer drains about a dozen houses on the south side of the Puercos and discharges one-fourth mile above the municipal sewer outlet. In the sand of the Puercos children play, and to the course of the stream for several miles below the town cows have free access. Through the Puercos, below the sewer outlets, thousands of sheep are driven to the railway's shipping pens located on the bank at this point. Dairy A, located 2½ miles below the sewer outlet, is usually protected from floods in the Puercos by the railroad embankment, which extends down the left bank past the farm, but the flood above-mentioned had dammed the Allison branch line railroad bridge, and the Puercos, thus diverted, had carried away about 200 yards of the main-line embankment and swept waist deep over the dairy premises. This same torrential downpour flooded many privy vaults in town and swept their dissolved contents down both hillsides into the flood, which thus contained representative fecal contamination from all parts of the town, both sewered and unsewered.

Sanitary History of the Town.

In New Mexico deaths, births, and disease are not regularly reported. Burial permits are not required, nor is the calling of a physician mandatory in any case. Gallup is no exception, but by careful inquiry among the physicians it was found that 10 cases of fever, 6 certainly and 4 probably typhoid, had occurred in town between February 25 and September 5. These pre-epidemic cases appeared to be unrelated to each other although 5 were in persons employed in or frequenting the railroad yards. Insanitary privies were used by all these patients, and during the first week of the disease, disinfection of excreta was usually omitted. Flies were plentiful until October.

The county health officer is paid only $300 per annum, the usual salary in New Mexico, which sum seems to be intended for the care of patients at the county hospital. It does not appear that anyone is directly charged with the protection of the water or milk supply, or with any other sanitary duty. A casual inspection of dairy A would have shown evidences of the flood and pollution. An employee of this dairy was admitted to the county hospital, September 20, for typhoid, and the brother of another died of typhoid October 2. In the first 65 cases studied, 61 patients used this milk either as a beverage or on cereal. Mrs. J. nursed her son through an attack of typhoid fever, meanwhile waiting on table at a restaurant. Her privy, primitive, leaky, and foul, was only 150 feet from the leaky cistern near pump No. 1 and directly up the hill from that point. The milk-borne infection might easily have become water borne and hence more general. It was no one's business to detect and correct such gross lapses in sanitation. Not a cent of money was spent in prevention.

At this point in the investigation an improvised hypochlorite plant for treating the city water was introduced, the same being a modification of that described in Public Health Reports, October 9, 1914, pages 2709–2715, "The chemical disinfection of water," by Earle B. Phelps, professor of chemistry, Hygienic Laboratory.

TABLE 1.—*Showing number of cases according to date of onset and relation to milk supply.*

	Families supplied.	Feb. 25.	Mar. 5.	July.		August.			September.													
				13	14	23	25	27	[1] 5	11	18	19	20	21	22	23	24	25	26	27	28	30
Dairy A	186	1	....	....	....	...	1	1	...	...	2	1	3	1	2	2	1	2	5	2	6	[2] 3
All other sources of fresh milk	90	....	1	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...
No fresh milk	149	....	....	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Unknown	....	....	....	...	...	1	...	...	...	...	...	...	[3] 1	...	...	...	...	...	1	1	[4] 1	...

	October.																		Total cases.
	1	2	4	5	6	7	8	9	11	12	14	15	16	17	18	19	20	22	
Dairy A	7	4	6	4	3	2	4	2	2	1	1	1	1	2	2	2	1	1	79
All other sources of fresh milk	...	...	...	....	...	...	...	....	1	....	....	....	....	....	....	....	....	....	4
No fresh milk	...	...	...	....	...	...	...	....	....	....	....	....	....	....	....	....	....	....	3
Unknown	...	...	[5] 2	....	...	...	...	....	....	....	....	[5] [6] 2	....	....	....	....	1	....	10

[1] Last of a series of floods, one of which inundated dairy A.
[2] Holbrook, Ariz., cases. Ice cream from soda fountain Y. Date of onset approximate.
[3] Employed at dairy A and living on the place.
[4] Dairy A milk on home table.
[5] One patient had dairy A milk on home table.
[6] One patient was employed at dairy A and lived on the place.

Table 1 shows 96 cases of typhoid studied. There were undoubtedly others. Nine were pre-epidemic cases occurring between February 25 and September 5. Of the 87 epidemic patients, 76 consumed milk from dairy A. Of the 11 remaining, 2 were employed at the dairy and 3 others are known to have been on its route. The inference is permissible that these 5 patients used milk from this dairy, but only those who are definitely known to have done so are so charted. Of the remaining 6, 1 received milk from another dairy, but in bottles belonging to dairy A; 4 histories were not obtainable; 1 patient, a boy who frequently played in the Puercos, was definitely known not to have taken infected milk.

The epidemic cases traceable to dairy A gave the following history as to the manner in which milk was consumed:

As a beverage; this includes those taking milk shakes and malted milk from dairy A at soda fountains	60
On cereal and fruit or on bread and milk, but not as a beverage	9
In hot coffee only	[1] 1
In ice cream only	5
In ice cream and also hot coffee	1
Total	76

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[1] This patient may have been infected by contact, as she sickened Oct. 11, having nursed her husband for typhoid since Sept. 19.

Ice Cream.

It is remarkable that only six cases were traceable to infected ice cream. This commodity, made with raw milk from dairy A, was sold extensively both in Gallup and at the mines until October 2. At the Allison mine alone from 7½ to 10 gallons per week were sold, largely to children, but no case of fever appeared at this place.

One of these six cases was secondary to a previous one in the same house and may easily have been due to contact. Three were out of town cases reported by Dr. J. W. Bazell, superintendent of the board of health, Navajo County, Holbrook, Ariz., who believes that he excluded every source of infection except ice cream from Gallup, containing raw milk from dairy A, which these patients are known to have consumed.

The age distribution of cases, counting the entire series, was as follows:

Under 11 years	38
11 to 20 years	28
21 to 30 years	13
More than 30 years	17
Total	96

The usual frequency of multiple cases in the same household occurring about the same time, common in milk infections, was found, as follows:

2 cases in same house in 7 instances.
3 cases in same house in 4 instances.
4 cases in same house in 2 instances.

Other possible sources of infection were investigated with negative results. Ice, fruit, green vegetables, and shellfish were found unrelated to cases. In all, except the Holbrook cases, the patients drank the same water. Three cases at the Gibson mine, among persons frequently visiting Gallup, are included in the series.

Recommendations.

The final report, handed to the local authorities on October 26, contained the following recommendations:

1. Typhoid and other contagious diseases to be reported to the health officer and preventive measures taken in each case.
2. Dairy A to continue pasteurization permanently. All dairies to be frequently inspected.
3. All insanitary privies to be replaced by toilets with sewer connections, or by an approved type of privy.
4. All specifically infected privies to be cleaned and disinfected.
5. Thorough sanitation of the neighborhood of the infected well and cistern, and abandonment of the latter. Continue the hypo-

chlorite treatment of water supply until repeated tests of 30 cubic centimeters of raw water show absence of colon bacilli.

6. Fly-suppressive measures.
7. Free laboratory examination of suspected typhoid specimens.
8. Extension of sewer mains to unused sandy flats near by; and construction of filter beds well protected from floods and fenced.

Acknowledgments.

It is a pleasure to acknowledge the ready and thorough cooperation of all the physicians in Gallup, each one of whom gave valuable assistance in furnishing data for the study, and with unfailing courtesy.

PLAGUE-PREVENTION WORK.

LOUISIANA—NEW ORLEANS—PLAGUE ERADICATION.

The following report of plague-eradication work at New Orleans for the week ended January 1, 1916, was received from Surg. Creel, of the United States Public Health Service:

OUTGOING QUARANTINE.

Vessels fumigated with sulphur	9
Vessels fumigated with carbon monoxide	13
Vessels fumigated with cyanide gas	3
Sulphur used, pounds	1,159
Coke consumed in carbon-monoxide fumigation, pounds	18,300
Cyanide used in cyanide-gas fumigation, pounds	96
Sulphuric acid used in cyanide-gas fumigation, pints	144
Clean bills of health issued	34
Foul bills of health issued	3

FIELD OPERATIONS.

Rodents trapped	8,273
Premises inspected	5,559
Notices served	877
Garbage cans installed	23

BUILDINGS RAT PROOFED.

By elevation	86
By marginal concrete wall	48
By concrete floor and wall	120
By minor repairs	257
Total buildings rat proofed	511
Concrete laid, square yards	10,988
Premises, planking and shed flooring removed	116
Buildings demolished	29
Total buildings rat proofed to date (abated)	97,996

LABORATORY OPERATIONS.

Rodents received by species:	
Mus rattus	159
Mus norvegicus	883
Mus alexandrinus	199
Mus musculus	5,902
Wood rats	166
Muskrats	138
Putrid (included in enumeration of species)	64
Total rodents received at laboratory	7,447
Rodents examined	2,210
Rats suspected of plague	26
Plague rats confirmed	1

PLAGUE RAT.

Case No. 271:
Address, Elevator "E" (outside).
Captured Nov. 26, 1915.
Diagnosis confirmed, Dec. 28, 1915.
Treatment of premises, intensive trapping; elevation of loose material about the railroad yards.

PLAGUE STATUS TO JAN. 1, 1916.

Last case of human plague, Sept. 8, 1915.	
Last case of rodent plague, Dec. 28, 1915.	
Total number of rodents captured to Jan. 1	559,643
Total number of rodents examined to Jan. 1	314,493
Total cases of rodent plague to Jan. 1, by species:	
Mus musculus	6
Mus rattus	18
Mus alexandrinus	9
Mus norvegicus	239
Total rodent cases to Jan. 1, 1916	272